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Notes:
1. Untranslatable words are replaced with asterisks ( ....
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2. Texts in the figures are not translated and shown as it is.
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[Document Name]Description
[Title of the Invention]Seal inspection system
[Claim(s)]
[Claim 1]A means to picturize a work bonded surface characterized by comprising the following where seal material was applied, A seal inspection system provided with an image memory which memorizes data taken in by this imaging means as image data, and a processing unit which performs shade Image Processing Division to said image data while being connected to this image memory.
An inspection part specific function to search a pixel position of an inspection width portion centering on an inspection point with which said processing unit was beforehand defined on said image data.
Both side detection function that judges a position of a pixel where a concentration change value turned into beyond a preset value among pixels from a both-ends position of said inspection width in said image data to said inspection point to be a crosswise both-ends position of said seal material.
A break error judging function judged about the inspection point concerned to be a seal break when said crosswise both ends are not detected by both this side detection function.
[Claim 2]The seal inspection system according to claim 1, wherein said processing unit is provided with an application state judging function judge that is [ an application state ] poor when said break error occurs continuously on two or more inspection points.
[Claim 3]The seal inspection system according to claim 1 characterized by setting up both ends of said inspection width on said work bonded surface while said inspection point is set as the center of the cross direction of seal material applied normally.
[Claim 4]The seal inspection system comprising according to claim 1,2, or 3:
An application width calculation function in which said processing unit computes width of seal material in the inspection point concerned based on a crosswise both-ends position detected by said both side detection function.

An application width error judging function judged about the inspection point concerned to be an application width error when application width computed by this application width calculation function is smaller than the minimum setting width defined beforehand.

[Claim 5]The seal inspection system according to claim 4, wherein said processing unit is provided with an application state judging function judge that is [ an application state ] poor when said application width error occurs continuously on two or more inspection points.
[Claim 6]The seal inspection system comprising according to claim 1,2, or 3:
The amount calculation function of gaps to judge the amount of gaps of an application position based on a crosswise both-ends position where said processing unit was detected by said both side detection function, and a position of said inspection point. A gap error judging function which shifts about the inspection point concerned and is judged to be an error when the amount of gaps computed by this amount calculation function of gaps is larger than the amount of setting gaps defined beforehand.
[Claim 7]The seal inspection system according to claim 6, wherein said processing unit is provided with an application state judging function judge that is [ an application state ] poor when said application gap error occurs continuously on two or more inspection points.
[Detailed Description of the Invention]
[OOOl]
[Industrial Application]This invention relates to a seal inspection system, and relates to improvement of a seal inspection system which judges in more detail the application state of the seal material applied in the shape of a bead using the automatic seal application device etc.
[0002]
[Description of the Prior Art]In performing a seal machine part mutual [ various ] recently, the seal method using silicone resin etc. is adopted.
[0003]Especially in an engine assembly process, Since an improvement of work environment etc. can be aimed at while application to an assembly line is also easy, liquefied seal material is breathed out from the nozzle provided along the bonded surface of a work so that movement was possible, and the device which applies this to a bonded surface automatically has come to spread.

[0004]When [ by the way, ] air etc. are mixed in seal material for a certain Reason in an above-mentioned application device, When carrying out discharge of the seal material from a nozzle, air blows off, it will be in what is called no-load striking ******, and there is inconvenience of checking the continuous discharge of seal material partially, or causing the abnormalities of partial application width, etc.
[0005]For this reason, it is necessary to inspect the state of the seal material applied to the bonded surface after the automatic application, and visual observation according [ this inspection ] to a worker is adopted, and also the application inspection by Image Processing Division which adopted the imaging means of a CCD camera etc. has come to be adopted.
[0006]
[Problem to be solved by the invention]However, in a visual check, since the abnormalities or defect of an application is what is generated rarely, when it originates in the belief with a thing without a defect and a defect actually occurs, it tends to produce the case where this is overlooked.
[0007]In order to judge the abnormalities of an application by a tester's subjectivity in a visual check, it is normal about an application state, or it difficult to make the standard of that unusual judgment uniform. That is, in a visual check, the application state judged to be unusual for some

testers of some may be judged to be normal by another tester, and a fixed quantity of evaluations of an application state of seal material cannot be changed.
[0008]In this inspection according to Image Processing Division on the other hand, there was inconvenience that accuracy reservation of an inspection result became difficult, by the inspection which is easy to produce variation in the concentration value in the photoed picture, and carries out Image Processing Division to it to the binary-ized image data. The picture at the time of presupposing that there is no diffused reflection of Lighting Sub-Division at the time of photography, when this was explained further in full detail can identify the seal material 41 clearly to the bonded surface 40, as shown in drawing 4 (A). It is because seal material is picturized to the bonded surface 40 usually being picturized brightly as for this more darkly than this brightness.
[0009]Therefore, if the picture shown in this drawing 4 (A) is binary-ized by a predetermined threshold, as shown in drawing 4 (B), the bonded surface 40 and the seal material 41 can be separated good, and, for this reason, it will become possible to catch the seal material 41 on the bonded surface 40. By counting the number of pixels dotted line within the limit [in the figure ], and comparing the number of pixels concerned with a preset value, the area to which seal material was applied can be caught and an application state can be inspected.
[0010]However, at the spot where the application of seal material is performed, since the installed position of Lighting Sub-Division is also restricted, inspection

environment is not necessarily good [ it is a part of manufacturing process, and / the surrounding brightness etc. ]. For this reason, on the occasion of actual photography, as shown in drawing 4 (C), Lighting Sub-Division may reflect by a part of seal material 41, it may become bright, and a part of this seal material 41 and the brightness of the bonded surface 40 may approximate. Therefore, if the picture shown in drawing 4 (C) is binary-ized, as shown in drawing 4 (D), it becomes less than seal material 41 actual portions, and even if the portion separated as the seal material 41 counts the number of pixels surrounded by the figure middle point line, it will judge that it is [ an application ] poor as the number of pixels of less than the number of setup.
[0011]That is, depending on inspection environment, the reflection of Lighting Sub-Division arose on the seal material 41, and since it was a reflection of this seal material portion, there was inconvenience of producing the erroneous decision of an application state. Therefore, because of the reflection of the seal material 41, when the bonded surface 40 was picturized in the state of an ideal, even if it could judge the application state by Image Processing Division, even if it conducted the automatic check by viewing, it was unreliable in an actual manufacturing process.
[0012]A setup of the threshold in the case of binary-izing in the technique of judging existence to be examined based on the number of pixels in the window of the binary-ized picture as shown in drawing 4 is difficult. In a certain inspection environment, the inconvenience of the threshold which acts good stopping separating a seal material portion and a bonded surface portion in other environments produces this. Whenever the Lighting Sub-Division position and strength are changed, it is too complicated to set up a threshold and it will bar automation of an inspection of an application state of the seal material by Image Processing Division. In an automatic setup of the threshold by a discriminant analysis method etc., it is needed for processing for a long time.
[0013]Thus. [ the inspection system of an application state of seal material ] Whether the

concentration in image data is not uniform and it is changing somewhat, when changing the Lighting Sub-Division position and illumination according to inspection environment, or visitor light reflects by a part of seal material and serves as the same brightness as a bonded surface, the technique of the ability to separate the seal material portion in image data is desired.
[0014]1t became clear that it was easy to generate the part which cannot identify seal material by reflection in the central part which meets in the application direction of seal material in fact. That is, it is hard to produce a reflection of Lighting Sub-Division, and the both-ends portion of the cross direction of the seal material 41 is darkly picturized by the thickness of seal material, etc. That is, the concentration of the central portion of the seal material 41 tends to be affected by the influence of Lighting Sub-Division, is stabilized about both ends to being unstable, and a concentration difference with the bonded surface 40 arises. Therefore, the crosswise both-ends concentration of seal material is clearly discriminable to the concentration of a bonded surface.
[oo15]

[Objects of the Invention]The purpose of this invention detects the existence of seal material based on change of concentration distribution which meets the crosswise both ends of seal material to the image data of a work bonded surface, It is in providing the seal inspection system which can perform the application state of seal material at high speed and with high precision by performing this detection for every inspection point which was able to be defined beforehand.
[0016]
[Means for solving problem]A means by which this invention picturizes the work bonded surface where seal material was applied in order to attain said purpose, The image memory which memorizes the data taken in by this imaging means as image data, While being connected to this image memory, have a processing unit which performs shade Image Processing Division to image data, and further, [ a processing unit ] The inspection part specific function to search the pixel position of the inspection width portion centering on the inspection point beforehand defined on image data, Both the side detection function that judges the position of a pixel where the concentration change value turned into beyond the preset value among the pixels from the both-ends position of the inspection width in image data to an inspection point to be a crosswise both-ends position of said seal material, The composition of having a break error judging function judged about the inspection point concerned to be a seal break when crosswise both ends are not detected by both this side detection function is taken.
[0017]The processing unit in a seal inspection system has taken the composition of having had the application state judging function judge that is [ an application state ] poor when a break error occurred continuously on two or more inspection points. While an inspection point is set as the center of the cross direction of the seal material applied normally, the composition that the both ends of said inspection width are set up on said work bonded surface is adopted preferably.
[0018]The application width calculation function in which a processing unit computes the width of the seal material in the inspection point concerned based on the crosswise both-ends position detected by both the side detection function, The composition of having an application width error judging function judged about the inspection point concerned to be an application width error when the application width computed by this application width calculation function is

smaller than the minimum setting width defined beforehand is taken.
[0019]The processing unit has taken the composition of having an application state judging function judge that is [ an application state ] poor when an application width error occurs continuously on two or more inspection points.
[0020]The amount calculation function of gaps in which a processing unit judges the amount of gaps of an application position based on the crosswise both-ends position detected by both the side detection function, and the position of an inspection point, The composition of having a gap error judging function which shifts about the inspection point concerned and is judged to be an error when the amount of gaps

computed by this amount calculation function of gaps is larger than the amount of setting gaps defined beforehand can also be adopted, and the various variations of an application state can inspect individually by this. Under the present circumstances, a processing unit is good to have composition provided with the application state judging function judge that is [ an application state ] poor, when said application width error occurs continuously on two or more inspection points.
[0021]
[Function]It precedes performing shade Image Processing Division, an inspection point is taught using the standard work in which the application of seal material was performed normally, and each inspection point is memorized in a processing unit. Then, image data is taken in by an imaging means to the subject of examination by which seal material was applied to the work bonded surface, and an image memory is made to memorize this. A processing unit performs shade Image Processing Division from a seal width for said every inspection point to the image data in an image memory. Here, it is judged by comparison with the concentration of a work bonded surface, and the both-ends concentration of seal material whether the both ends of seal material were detected. The concentration difference is set up based on the color of a work bonded surface and seal material, or the reflectance of light, and can judge the existence of seal both ends based on the preset value of the concentration difference.
[0022]When the both ends of the seal material in a specific inspection point cannot be detected, the seal piece of the inspection point concerned counts. And when the following inspection point cannot still perform both-ends detection of seal material, the count of a seal piece is integrated. When the count number of the seal piece continuous in this way exceeds an allowable predetermined number, it is regarded as a seal piece and it is judged that an application is unusual.
[0023]1n the composition which gave the function to detect the minimum setting width of seal material to the processing unit, it becomes possible to also detect simultaneously the seal application width and the width gap in each inspection point besides a seal piece.
[0024]
[Working example]Hereafter, one embodiment of the seal inspection system concerning this invention is described, referring to Drawings.
[0025]The block lineblock diagram of the seal inspection system is shown in drawing 1. In this figure, as for the inspection work 10, the engine head cover of the car, etc. are made into the

object, and the seal material 41, such as silicone resin, is applied to the bonded surface 40 of this work 10. The application of the seal material 41 is performed by the robot which is not illustrated for seal material 41 applications. This seal material application robot equips the bonded surface 40 with the nozzle which carries out discharge of the seal material 41, and the nozzle driving means to which

this nozzle is moved along the bonded surface 40, and drive control of the nozzle driving means is carried out at the robot controller 11. This robot controller 11 carried out teaching of the nozzle on the application locus along the bonded surface 40 of the work 10, and is provided with the function to which the seal material 41 is made to apply one by one to the bonded surface 40 of the work 10 produced continuously.

[0026]1n the upper part in the inspection position of the work 10, two or more CCD cameras 12 and lighting installations 13 which constitute an imaging means are arranged. In this example, the effective pixels of CCD camera 12 are 768(H) x494(V). The bonded surface 40 in the inspection work 10 is picturized in monochrome.

The object distance of CCD camera 12 and the work 10 is set up to such an extent that a seal can take a photograph within these effective pixels in the size which is about 4-6 pixels. The position of the work to be examined and CCD camera 12 is being fixed, and the bonded surface 40 of the work 10 is always picturized in the same position.

[0027]The picture change machine 14 is put side by side to said CCD camera 12, and this picture change machine 14 switches CCD camera 12 one by one according to the position for an image pick-up, and inputs into the digitizer 15 the analog image data which CCD camera 12 under connection picturized.

[0028]The A/D conversion machine 16 which changes into digital image data the analog image data to which CCD camera 12 outputs the digitizer 15, It is constituted by the image memory 17 which memorizes the image data which this A/D conversion machine 16 outputs, and D/A converter 18 which carries out analog conversion of the image data in this image memory 17 for monitor displays. Here, the A/D conversion machine 16 has changed analog image data into the digital image data of 256 gradients (from a concentration value "0 .... to 255"). Hereafter, the digital image data of these 256 gradients is only called image data.

[0029]On the other hand, the inside-and-outside monitors 19 and 20 and the printer 21 are connected to D/A converter 18. In order to carry out D/A conversion of the image data once accumulated in the image memory 17 and to display on the monitors 19 and 20, the coordinates of the picture displayed on the monitor and the coordinates by the address of the image memory 17 correspond. Therefore, the position directed by the operator to the picture displayed on the monitors 19 and 20 corresponds to the address of the image memory 17, and is equivalent to the position of the bonded surface 40 picturized by CCD camera 12 further.

[0030]And since the position of CCD camera 12 is being fixed, it is specified here to what mm of the bonded surface 40 the length in every direction which is 1 pixel of the image data in the image memory 17 corresponds. Since this actual size of 1 pixel is specified, it becomes possible to display the actual length of the image data on a monitor collectively.

[0031]The printer 21 is put side by side to D/A converter 18, and it is constituted so that the

printout of image data, the inspection result, etc. can be carried out if needed.

[0032]The microcomputer 25 as a processing unit is connected to said image memory 17. This microcomputer 25 performs shade Image Processing Division to the image data accumulated in the image memory 17, and directs the timing of the drive control by the robot controller 11, etc. Memory measures which memorized in fact the program the control procedure was indicated to be beforehand and which are not illustrated, such as a hard disk or ROM, are put side by side in the microcomputer 25.
[0033]The microcomputer 25 is provided with the circuit which inputs the photography start signal outputted from the robot controller 11 via the I/O board 26 while it outputs a predetermined application start signal and the end signal of an inspection to the robot controller 11. A predetermined parameter is inputted into the microcomputer 25 by the keyboard 24 connected outside. Specifically, a setup of an inspection starting position, the inspection start direction, an end position of an inspection, permission piece width, allowable width, etc. according to the subject of examination at the time of executing the program for instruction is arbitrarily enabled as variable information.
[0034]The inspection position specific part 25A by which said microcomputer 25 defines the inspection point of an application state of seal material on image data according to various programs, It has the application state inspection section 25B which judges the application state of the seal material of the inspection point p with this defined inspection position specific part 25A by Image Processing Division.
[0035]The inspection position specific part 25A pinpoints the position where seal material must be applied. That is, the coordinates from which existence of seal material must be detected are specified among the image data of 512x512 picturized with CCD camera 12. When seal material is extracted good, the line continuous considering 4-6 pixels as thickness is detected by this image data. The position of this line becomes settled with an application position about the seal material 41 to the shape and this bonded surface 40 of a work.
[0036]The inspection position specific part 25A displays the image data of the bonded surface 40 where seal material was applied normally first on the monitors 19 and 20. Or the position where seal material should be applied normally is smeared away black, for example, and the image data of the bonded surface 40 concerned is displayed on a monitor. Subsequently, it receives from an operator as coordinate information on a monitor of an inspection starting position and the end position of an inspection. If directions of the search direction are received from an operator, search processing will detect automatically the application position of seal material meeting the shape of the work as coordinates of an image memory.
[0037]Here, it carries out by pursuing at a time 1 pixel of pixels judged to be the seal material in image data. In this search processing, it asks for the number of what pixel is continuing by going straight to the search direction first, and when the continuous number of pixels is larger than a fiducial point, 1 pixel progresses in that direction and coordinates are recorded.
[0038]When the number of continuation is smaller than a fiducial point, it is judged as

the bend portion of a seal and the new search direction is determined. When it cannot go straight

on, the direction of 45 right and left is investigated, and comparison of a concentration value determines a new direction.
[0039]Subsequently, make into a standard concentration value the average of the concentration of the pixel which adjoins the concentration and the direction of movement of the present position, and let the average of the concentration of previous 2 and 3rd pixel be a comparison concentration value from the present position. And when a standard concentration value is beyond a comparison concentration value, the position which he followed in the direction 1 pixel, and followed is appeared, and coordinates are recorded as a position.
[0040]Whenever it searches and records coordinates, when it checks whether the position concerned is the range of an end position and goes into end within the limits, it judges with it being normal and ends. The case where search separated from the seal material 41 and it becomes impossible to search normally on the other hand is considered, and even if it repeats the number-of-times search of fixed, in not arriving at an end position, it judges with it being unusual and ends.
[0041]Thereby, it is extracted as a line by which seal material was applied. The inspection point of the point of the constant interval on this line is carried out, and coordinates are specified. At this time, an inspection point is set as the center of fixed width.
[0042]Both the side detection function in which said application state inspection section 25B judges the position where the concentration change value of the cross direction of the seal material 41 in the inspection point beforehand defined on image data turned into beyond the preset value to be a crosswise both-ends position of the seal material concerned, When crosswise both ends are not detected by both this side detection function, it has the break error judging function judged about the inspection point concerned to be a seal break.
[O043]The application width calculation function in which the application state inspection section 25B computes the width of the seal material in the inspection point concerned based on the crosswise both-ends position detected by both the side detection function, When the application width computed by this application width calculation function is smaller than the minimum setting width defined beforehand, it has the application width error judging function judged about the inspection point concerned to be an application width error.
[0044]The amount calculation function of gaps in which the application state inspection section 25B judges the amount of gaps of an application position based on the crosswise both-ends position detected by both the side detection function, and the position of said inspection point, When the amount of gaps computed by this amount calculation function of gaps is larger than the amount of setting gaps defined beforehand, it has the gap error judging function which shifts about the inspection point concerned and is judged to be an error.

[0045]1n this example, since it has judged with an application state being poor when each error arises continuously on two or more inspection points, the application state inspection section 25B has the error counter which counts the number of times of each error.
[0046]Next, the application state inspection section 25B is explained in detail.
[0047]The application state inspection section 25B checks existence of seal material by detecting the large portion of shade change to the image data accumulated in the image memory 17. Here,

as shown in drawing 2, three elements of the break of seal material, application width, and a gap of a seal material application position are checked as an inspection of an application state. First, with reference to drawing 3, it explains and ranks second about the extraction technique of the seal material portion by Image Processing Division, and the processing process of the application state inspection section 25B which inspects the application state of seal material is explained.
[0048]The inspection point p is defined as the center position of the cross direction of the seal material 41 applied to the work bonded surface 40. This inspection point p is arranged along the application direction of the seal material 41 at a constant interval. The inspection width w is defined to the inspection point p. this -- the cross direction of an inspection point to seal material -- constant distance -- it is set up widely and the both ends of this inspection width w are located in the work bonded surface 40 here.
[0049]The application state inspection section 25B detects the concentration change from the pixel of the both ends of the inspection width w to the pixel of the inspection point p. As mentioned above, since the edge part of the cross direction of the seal material 41 cannot be easily affected by the influence of reflective of Lighting Sub-Division, [ the application state inspection section 25B ] Concentration change of a pixel adjacent in the direction of inspection point p from the concentration of the pixel of the both ends of the inspection width w is computed, and if this concentration change is change beyond a preset value, it will be judged that it is the edge of seal material.
[0050]Since the concentration change concerned is judged that the positions which are the pixels beyond a preset value are the both ends of seal material among pixels until it results from the both ends of the inspection width w to the inspection point p, [ the application state inspection section 25B ] A width in one point (inspection point) of the seal material applied on the bonded surface 40 picturized with CCD camera 12 can be extracted, the thing whose width of the seal material in the inspection point p picturized with this CCD camera 12 by comparing with the number of pixels according to the width at the time of being applied normally since the width of this detected seal material is computed as the number of pixels is thinner than normalcy -- or thick one can be judged quantitatively.
[0051]Since the inspection point p is set as the center position of the cross direction of the seal material applied normally, It can be quantitatively judged how much seal

material is shifted from the position which should be applied essentially by comparing the position of this inspection point p with the position of the pixel judged to be both the sides (edge) of seal material. Since CCD camera 12 picturizes the work bonded surface 40 so that the width of the seal material applied normally may be 4-6 pixels, it can detect the width and the amount of gaps of this seal material per milli.
[0052]The application state inspection section 25B detects the width of this seal material for every inspection point arranged with a constant interval in the application direction of seal material. The application state inspection section 25B judges that the break has arisen in the application direction of seal material, when detection of the width of seal material goes wrong continuously about two or more inspection points p at this time.
[0053]Here, the inspection process of an application state of the seal material by the composition

shown in drawing 1 is explained based on the flow chart of drawing 2.
[0054]First, an illumination inspection is conducted (Step $1). Since the concentration of the edge part of the seal material 41 and the concentration of bonded surface 40 portion approximate this and it becomes impossible to detect the both ends (both sides) of the cross direction of the seal material based on concentration change good when Lighting Sub-Division becomes dark, it conducts an illumination inspection before the image pick-up by CCD camera 12. When an illumination inspection is NG, processing is ended, without inspecting as Lighting Sub-Division being faulty (Step $2).
[0055]Subsequently, detection processing of both the sides of seal material is performed about the inspection point p beforehand defined to the image data picturized with CCD camera 12. An application state is inspected based on this detection result.
[0056]Step $3 to the step $18 shown in drawing 2 is a flow of the processing about the one inspection point p. Since two or more inspection points p are defined along the work bonded surface 40 to image data, it is judged whether both side detection processing of all the inspection points p defined by Step $18 to this image data was completed.
[0057]1n the inspection of an application state shown in this drawing 2, a gap (Steps $13-$16) of the break (Steps $3-$6) of an application of seal material, the width of the applied seal material, and the application position of (Step $8-$9) and seal material is inspected. In this example, in each inspection, when the break etc. have occurred not on one inspection point but on the continuous inspection point, it judges with an error (defect of an application state).
[0058]1n Step $3, the existence which is the pixel which concentration change produced beyond the preset value among the pixels of a to [ from the inspection width w mentioned above / the inspection point p ] is detected. When both the sides of a seal width are not detected, the increase of the value of a break error counter in "1" is carried out (Step $4). When the value of a break error counter is beyond a preset value

(i.e., when judged with a break on the inspection point p more than a number of the numbers of inspection points defined beforehand) (Step $5), it is considered as a break and a gap error by setting NG flag to "ON" (Step $6). Suppose that there is possibility of a gap error because you assumed the case where the seal material 41 was applied out of the inspection width w.
[0059]When both the sides of seal material are detected at Step $3, a break error counter is initialized first (Step $7). The number of pixels between both the sides of the seal material concerned is computed, and it is checked whether the width of the seal material concerned is more than the minimum setting width based on this number of pixels (Step $8). When it is less than the minimum setting width (i.e., when it is the number of pixels of 4 to 6 pixels or less in an above-mentioned example), the increase of the value of a width error counter in "1" is carried out (Step $9). Subsequently, it is checked whether the value of this width error counter is beyond a preset value (Step $10). That is, it is checked whether the inspection point p which is less than the minimum setting width is continuing. When judged with the width of seal material being continuously small on the inspection point p more than a number of the numbers of inspection points set up beforehand, it is considered as a width error by setting NG flag to "ON" (Step $11 ).
[0060]When judged with more than the minimum setting width at Step $8, the value of a width

error counter is initialized first (Step $12). Based on the pixel position of both the sides of the seal material concerned, and the position of the pixel of an inspection point, it is checked whether both the sides concerned are located within a setting gap (Step $13). When it is over the setting gap range, it shifts like other cases and the increase of the value of an error counter in "1" is carried out (Step $15). When judged with having generated on the inspection point p on which the gap of this application position continued (Step $15), it is considered as a gap error by setting NG flag to "ON" (Step SI 1).

[0061]When both the side position of seal material is judged at Step $13 to be less than a setting gap, a gap error counter is initialized first (Step $17). When each error is not made to more than a predetermined number by processing from this step $3 to $17, the application state chooses the following inspection point and returns processing to Step $3 noting that it is good.

[0062]On the other hand, when judged with NG, it indicates by external that the application state of seal material is NG as it is, and may be made to end processing, but in order to acquire the information on what kind of error occurred on which inspection point, the following inspection point is chosen and processing is returned to Step $3 here. In this example, specification with poor operation of an application robot is performed based on the error information for every inspection point of this. Based on this error information, operation of an application robot is controlled and it may be made to apply seal material again. That is, the microcomputer 25 may make application control of seal material perform for the robot controller 11 again based on the position corresponding to an inspection point, and the error classification of the inspection point concerned.

[0063]After processing is completed about all the inspection points (Step $18), the

state of NG flag is checked (Step $19), if NG flag is ON, NG will be outputted (Step $20), and if NG flag is not ON, on the other hand, O.K. will be outputted (Step $21). The inspection result of an application state of the seal material automatically performed by Image Processing Division is indicated by external. It may be made to give the monitors 19 and 20 this external display, and can print with the printer 21.

[0064]When there are two or more CCD cameras 12 according to the size of a work, after processing is completed about one image data, the input of CCD camera 12 is changed with the picture change machine 14, and processing about the following image data is performed.

[0065]Thus, in order to detect the existence of seal material by detection of the edge part of seal material according to the inspection process shown in drawing 2, Even if a manufacturing process etc. are the image pick-up environment which is not necessarily good, both the sides of seal material are detectable good, and for this reason, the application state of the seal material by Image Processing Division can be inspected, without considering it as ideal lighting environment.

[0066]1n order to judge the pixel which concentration change produced from the both ends of inspection width toward the inspection point beyond the preset value to be the both ends of seal material, The width of seal material can be quantitatively caught with the number of pixels, and since it is specified to what mm of the bonded surface 40 where 1 pixel is actual it corresponds by pinpointing a CCD camera position, it is correctly computable what mm the width of the seal material defined by this number of pixels is actually.

[0067]And even if lighting environment is not good and diffused reflection has arisen somewhat on the bonded surface 40 even if the brightness in a field to be examined is not uniform namely, in order to make the both ends of inspection width into a starting position and to detect the amount of concentration change on the basis of the concentration value of the pixel of the position concerned, it is stabilized and an exact judgment can be performed.
[0068]Since an inspection point corresponds with the position on the actual bonded surface 40, based on the error situation for every inspection point, seal material can be applied automatically and exact again about the position which was not applied good by controlling seal material application operation of a robot controller.
[0069]
[Effect of the Invention]Since this invention is constituted as mentioned above and acts, according to this. In order that both the side detection function may judge the position of a pixel where the concentration change value turned into beyond the preset value among the pixels from the both-ends position of the inspection width in image data to an inspection point to be a crosswise both-ends position of seal material, The existence of the seal material 41 based on the portion of the both ends of the seal material 41 always ****(ed) darkly is detectable, When a break error judging function is

not detected [ crosswise both ends ] by both this side detection function, in order that the inspection point concerned may be judged with a seal break, The seal inspection system which generates the outstanding effect which is not in the former that the seal break which is a defect of an application state of the seal material 41 is automatically detectable by Image Processing Division can be provided.
[0070]Since the both ends of inspection width were set up on the work bonded surface 40, if a processing unit searches the pixel position of the inspection width portion centering on the inspection point beforehand defined on image data, [ a processing unit ] the gradation sequence which the both-ends position of this inspection width serves as a pixel on the bonded surface 40, and for this reason serves as a standard when calculating a concentration change value -- a value -- the gradation sequence on the bonded surface 40 -- it being considered as a value and, Therefore, even when the concentration value of the bonded surface 40 changes with Lighting Sub-Division, the seal material 41 can be detected on the basis of this concentration value that changed, and, for this reason, it can carry out by being stabilized without being affected by the influence of the change of inspection environment by the inspection of an application state of the seal material 41.
[0071 ]In order that an application width calculation function may compute the width of the seal material in the inspection point concerned based on the crosswise both-ends position detected by both the side detection function, Can compute the width of the seal material 41 on the bonded surface 40 which ****(ed) as the number of pixels, and, moreover, [ this pixel ] Since it corresponds with the size on the actual bonded surface 40, based on the number of pixels concerned, the application width of the seal material 41 on the bonded surface 40 is computable, And when an application width error calculation function has the application width smaller than the minimum setting width defined beforehand computed by this application width calculation function, in order

to judge the inspection point concerned with an application width error, The state of application width can be judged by Image Processing Division which is called comparison of the number of pixels and which can be performed at high speed.
[0072]When the error of application width arises continuously on two or more inspection points, in order to judge with an application state being poor, If it judges with an application state being poor when the case where the seal material 41 of a quantity required at the time of junction is not applied can be detected good according to the shape of the bonded surface 40, etc. and it moreover produces continuously on two or more inspection points, Since it does not judge that this is [ an application state ] poor even when an erroneous decision is carried out to the error of application width by the noise etc. on one inspection point, the defect of an application state can be judged without being affected by the influence of a noise.
[0073]1n order that the amount calculation function of gaps may judge the amount of gaps of an application position based on the crosswise both-ends position detected by both the side detection function, and the position of an inspection point, It comes out to provide the seal inspection system which generates the outstanding effect which is not in the former that the amount of gaps of the seal material 41 actually applied from the position of the inspection point defined beforehand can be quantitatively judged as the number of pixels.

[0074]When an application state judging function generates a processing unit continuously on the inspection point of plurality [ error / application gap ], in order to judge with an application state being poor, It comes out to provide the seal inspection system which generates the outstanding effect which is not in the former that an application state can be judged without being affected by the influence by the noise in one inspection point, etc.
[Brief Description of the Drawings]
[Drawing 1]It is a block lineblock diagram showing one embodiment of the seal inspection system concerning this invention.
[Drawing 2]It is an inspection flow chart of said seal inspection system.
[Drawing 3]It is an outline top view of a seal inspection point.
[Drawing 4](A) - (D) is an explanatory view of the conventional example which binary-izes image pick-up data and conducts a seal inspection.
[Explanations of letters or numerals]12 CCD camera 15 digitizer 17 image-memory 25 Microcomputer 40 as a processing unit Bonded surface 41 Seal material
[Translation done.]